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ABSTRACT

This booklet provides an introduction to project-based instruction, explaining the research-based rationale for using the approach and outlining how the approach can increase students' engagement and knowledge retention. It offers guidelines for planning and implementing projects and includes a checklist of important things to keep in mind when developing appropriate projects. Assessment considerations, potential pitfalls, and ways to avoid pitfalls are also discussed. The chapters are as follows: "What is Project-Based Instruction?"; "Benefits of Project-Based Instruction"; "Implementing Project-Based Instruction" (essentials for structuring projects effectively, project ideas, what to watch for, and avoiding pitfalls); "Assessment of Project Work" (e.g., purpose of the assessment, identify instructional goals and outcomes to develop appropriate assessments, selecting assessment tasks, student self-assessment, and project assessment); "Professional Development for Teachers" (skills of an effective coach); "Conclusion"; "Northwest Sampler" (case studies from five schools); and "Online Resources for Project Ideas." (Contains 37 references.) (SM)

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PROJECT-BASED INSTRUCTION: Creating Excitement for Learning

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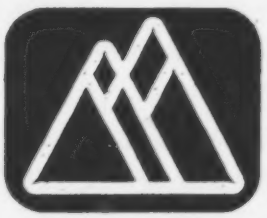
PLANNING & PROGRAM DEVELOPMENT



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FOREWORD

This booklet is the 20th in a series of "hot topic" reports produced by the Northwest Regional Educational Laboratory. These reports briefly address current educational concerns and issues as indicated by requests for information that come to the Laboratory from the Northwest region and beyond. Each booklet contains a discussion of research and literature pertinent to the issue.

One objective of the series is to foster a sense of community and connection among educators. Another is to increase awareness of current education-related themes and concerns. Each booklet gives practitioners a glimpse of how fellow educators are addressing issues, overcoming obstacles, and attaining success in certain areas. The goal of the series is to give educators current, reliable, and useful information on topics that are important to them.

INTRODUCTION

"Tell me and I forget. Show me and I remember. Involve me and I understand." —Chinese proverb

Keeping children engaged and motivated in school is challenging, even for the most experienced teachers. Although it is difficult to prescribe a "one-size-fits-all" approach, research shows that there are practices that will generally encourage students to be more engaged. These practices include moving away from rote learning and memorization to providing more challenging, complex work; having an interdisciplinary, rather than departmentalized focus; and encouraging cooperative learning (Anderman & Midgley, 1998; Lumsden, 1994). Project-based instruction incorporates these principles.

Using projects as part of the curriculum is certainly not a new concept; teachers often incorporate projects into their lesson plans. Project-based instruction is different: It is a holistic instructional strategy rather than an add-on. Project-based work is an important part of the learning process. This approach is becoming even more meaningful in today's society as teachers increasingly teach groups of children who have different learning styles, cultural and ethnic backgrounds, and ability levels. The so-called cookie-cutter approach to learning does not help all kids achieve high standards. Project-based instruction builds on children's individual strengths, and allows them to explore their interests in the framework of a defined curriculum.

This booklet provides an introduction to project-based instruction. It explains the research-based rationale for using the approach and outlines how the approach can increase

students' engagement and knowledge retention. The booklet offers guidelines for planning and implementing projects, and includes a checklist of important things to keep in mind when developing appropriate projects. Assessment considerations are addressed; potential pitfalls and ways to avoid them are discussed. The Northwest Sampler section profiles schools that are implementing project-based instruction. Finally, a list of resources for further reading is offered to provide more indepth tools for project-based learning implementation.

WHAT IS PROJECT-BASED INSTRUCTION?

Project-based instruction is an authentic instructional model or strategy in which students plan, implement, and evaluate projects that have real-world applications beyond the classroom (Blank, 1997; Dickinson, et al, 1998; Harwell, 1997). Learning activities that are interdisciplinary, long term, and student centered are emphasized, rather than short, isolated lessons (Challenge 2000 Multimedia Project, 1999). Project-based instructional strategies have their roots in the constructivist approach evolved from the work of psychologists and educators such as Lev Vygotsky, Jerome Bruner, Jean Piaget and John Dewey. Constructivism views learning as the result of mental construction; that is, children learn by constructing new ideas or concepts based on their current and previous knowledge (Karlin & Vianni, 2001).

Most important, students find projects fun, motivating, and challenging because they play an active role in choosing the project and in the entire planning process (Challenge 2000 Multimedia Project, 1999; Katz, 1994).

Elements of an authentic project

There are a wide range of project types—service learning projects, work-based projects, and so forth, but authentic projects all have in common these defining features (Dickinson et al., 1998; Katz & Chard, 1989; Martin & Baker, 2000; Thomas, 1998).

- Student centered, student directed
- A definite beginning, middle, and end
- Content meaningful to students; directly observable in their environment
- Real-world problems
- Firsthand investigation
- Sensitivity to local culture and culturally appropriate
- Specific goals related to curriculum and school, district, or state standards
- A tangible product that can be shared with the intended audience
- Connections among academic, life, and work skills
- Opportunity for feedback and assessments from expert sources
- Opportunity for reflective thinking and student self-assessment
- Authentic assessments (portfolios, journals, etc.)

BENEFITS OF PROJECT-BASED INSTRUCTION

How does project-based instruction benefit students? This approach motivates children to learn by allowing them to select topics that are interesting and relevant to their lives (Katz & Chard, 1989). Additionally, 20 years of research indicate that engagement and motivation lead to high achievement (Brewster and Fager, 2000). Research on the long-term effects of early childhood curricula supports the rationale for incorporating project-based learning into early childhood education and secondary education (Katz & Chard, 1989).

Teachers are increasingly working with children who have a wide range of abilities, come from various cultural and ethnic backgrounds, and are English language learners. Schools are seeking ways to respond to the needs of these students. Project-based instruction provides one way to introduce a wider range of learning opportunities into the classroom. It can engage children from diverse cultural backgrounds because children can choose topics that are related to their own experiences, as well as allow them to use cultural or individual learning styles (Katz & Chard, 1989). For example, traditional Native American ways of teaching stress hands-on and cooperative learning experiences (Clark, 1999; Reyes, 1998).

Incorporating projects into the curriculum is neither new nor revolutionary. Open education in the late 1960s and early 1970s strongly emphasized active engagement in projects, firsthand learning experiences, and learning by doing (Katz & Chard, 1989). The Reggio Emilia approach to early childhood education, recognized and acclaimed as one of the best

systems of education in the world, is project-based (Abramson, Robinson, & Ankenman, 1995; Edwards. Gandini, & Forman, 1993).

Particular benefits of project-based instruction include:

- *Preparing children for the workplace.* Children are exposed to a wide range of skills and competencies such as collaboration, project planning, decisionmaking, and time management (Blank, 1997; Dickinson et al., 1998).

- *Increasing motivation.* Teachers often note improvement in attendance, more class participation, and greater willingness to do homework (Bottoms & Webb, 1998; Moursund, Bielefeldt, & Underwood, 1997).

- *Connecting learning at school with reality.* Students retain more knowledge and skills when they are engaged in stimulating projects. With projects, kids use higher order thinking skills rather than memorizing facts in an isolated context without a connection to how and where they are used in the real world (Blank, 1997; Bottoms & Webb, 1998; Reyes, 1998).

- *Providing collaborative opportunities to construct knowledge.* Collaborative learning allows kids to bounce ideas off each other, voice their own opinions, and negotiate solutions, all skills that will be necessary in the workplace (Bryson, 1994; Reyes, 1998).

- *Increasing social and communication skills*

- *Increasing problem-solving skills* (Moursund, Bielefeldt, & Underwood, 1997)

- *Enabling students to make and see connections between disciplines*
- *Providing opportunities to contribute to their school or community*
- *Increasing self-esteem.* Children take pride in accomplishing something that has value outside the classroom (Jobs for the Future, n.d.).
- *Allowing children to use their individual learning strengths and diverse approaches to learning* (Thomas, 1998).
- *Providing a practical, real-world way to learn to use technology* (Kadel, 1999; Moursund, Bielefeldt, & Underwood, 1997).

A teacher in Washington State who has used project-based instruction in his math and science classes reports that many students who often struggle in most academic settings find meaning and justification for learning by working on projects (Nadelson, 2000). The teacher also notes that by facilitating learning of content knowledge as well as reasoning and problem-solving abilities, project-based instruction can help students prepare for state assessments and meet state standards.

IMPLEMENTING PROJECT-BASED INSTRUCTION

Essentials for Structuring Projects Effectively

Projects come from different sources and develop in different ways. There is no one correct way to implement a project, but there are some questions and things to consider when designing effective projects (Edwards, 2000; Jobs for the Future, n.d.)

Outlining Project Goals

It is very important for everyone involved to be clear about the goals so that the project is planned and completed effectively. The teacher and the student should develop an outline that explains the project's essential elements and expectations for each project. Although the outline can take various forms, it should contain the following elements (Bottoms & Webb, 1998):

- *Situation or problem*: A sentence or two describing the issue or problem that the project is trying to address. Example: Homes and businesses in a lake watershed affect the lake's phosphorus content, which reduces the lake's water quality. How can businesses and homeowners improve the quality of the lake water?

- *Project description and purpose*: A concise explanation of the project's ultimate purpose and how it addresses the situation or problem. Example: Students will research, conduct surveys, and make recommendations on how businesses and homeowners can reduce phosphorus content in

lakes. Results will be presented in a newsletter, information brochure, community fair, or Web site.

- *Performance specifications*: A list of criteria or quality standards the project must meet.

- *Rules*: Guidelines for carrying out the project. Include timeline and short-term goals, such as: Have interviews completed by a certain date, have research completed by a certain date.

- *List of project participants with roles assigned*: Include project teammates, community members, school staff members, and parents.

- *Assessment*: How the student's performance will be evaluated. In project-based learning, the learning process is being evaluated as well as the final product.

The outline is crucial to the project's success—teachers and students should develop this together. The more involved the students are in the process, the more they will retain and take responsibility for their own learning (Bottoms & Webb, 1998).

Identify Learning Goals and Objectives

Before the project is started, teachers should identify the specific skills or concepts that the student will learn, form clear academic goals, and map out how the goals tie into school, state, and/or national standards.

Herman, Aschbacher, and Winters (1992) have identified five questions to consider when determining learning goals:

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1. *What important cognitive skills do I want my students to develop?* (e.g., to use algebra to solve everyday problems, to write persuasively). Use state or district standards as a guide.

2. *What social and affective skills do I want my students to develop?* (e.g., develop teamwork skills).

3. *What metacognitive skills do I want my students to develop?* (e.g., reflect on the research process they use, evaluate its effectiveness, and determine methods of improvement).

4. *What types of problems do I want my students to be able to solve?* (e.g., know how to do research, apply the scientific method).

5. *What concepts and principles do I want my students to be able to apply?* (e.g., apply basic principles of ecology and conservation in their lives, understand cause-and-effect relationships).

Be as specific as possible in determining outcomes so that both the student and the teacher understand exactly what is to be learned.

Other things that teachers and students need to consider:

- *Do the students have easy access to the resources they need?* This is especially important if a student is using specific technology or subject-matter expertise from the community.
- *Do the students know how to use the resources?* Students who have minimal experience with computers, for example, may need extra assistance in utilizing them.

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- *Do the students have mentors or coaches to support them in their work?* This can be in-school or out-of-school mentors.

- *Are students clear on the roles and responsibilities of each person in a group?*

Cross Curriculum Project Planning

Many projects can involve teachers from several subject areas. Cross-curriculum projects allow students to see how knowledge and skills are connected in the workplace (Bottoms & Webb, 1998). These projects require advance planning and teamwork among teachers, but can be well worth it.

The principal plays a key role in the success of across-the-curriculum projects. If teachers are given the resources and time to develop such projects and have the enthusiasm and backing of the principal, they will feel freer to launch into projects.

Here are some ideas for successful cross-curriculum project planning:

- *Start early.* Staff members might need to spend more staff development time in the summer to plan adequately for complex projects.

- *Be clear about alignment of content to standards.* Teachers could map out what concepts each teacher plans to teach month by month, so that teachers can see overlap in different classes and can identify what content will be covered to ensure that the students learn a concept necessary for a project. Teachers can see clearly how working together on a project will tie in with their curriculum goals (Bottoms & Webb, 1998).

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- *Schedule time for students in different classes to work on projects together.* If this isn't possible during the day, teachers may find that as students get more involved and excited about working on projects, they are more willing to come in before or after school to meet with other students.

Project Ideas

There are many types of effective projects. Some projects can address a specific community or school need, transform existing work experiences or jobs into projects, or develop a project based on classroom curriculum (Dickinson, et al., 1998; Martin & Baker, 2000). Other projects can focus on career research (Bottoms & Webb, 1998).

Here are some ideas for projects:

- Design a living history museum or recreate an historical event.
- Design and plan a community garden.
- Develop a newsletter or Web site on a specific issue relevant to the school or community (school safety, recycling, how businesses can save energy and reduce waste, etc).
- Conduct a survey of historical buildings.
- Create a book on tape for senior center or elementary school class.
- Create a wildlife or botanical guide for a local wildlife area.
- Compile oral histories of the local area by interviewing community elders.
- Create an exhibit in a local museum or community center, produce audiotapes, videotapes, and books with historic photographs. Produce a Web site as a "virtual tour" of the history.

The possibilities for projects are endless. The key ingredient for any project idea is that it is student driven, challenging, and meaningful.

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It is important to realize that using project-based instruction does not mean doing away with a structured curriculum. Project-based instruction complements, builds on, and enhances what children learn through systematic instruction. Teachers do not let students become the sole decision-makers about what project to do, nor do teachers sit back and wait for the student to figure out how to go about the process, which may be very challenging (Bryson, 1994). This is where the teacher's ability to facilitate and act as coach plays an important part in the success of a project. The teacher will have brainstormed ideas with the student to come up with project possibilities, discuss possibilities and options, help the student form a guiding question, and be ready to help the student throughout the implementation process (e.g., setting guidelines, due dates, resource selection, etc.) (Bryson, 1994; Rankin, 1993).

Because there are so many more types of projects than room to list them here, a list of resources for projects is included in the reference section. One book for project selection ideas for younger children is *Engaging Children's Minds: The Project Approach* by Lilian G. Katz and Sylvia C. Chard. This book gives excellent suggestions on how to brainstorm topics with students and offers many project ideas. Another excellent resource for grades K-8 is *Creating and Assessing Performance-Based Curriculum Projects: A Teacher's Guide to Project-Based Learning and Performance Assessment* by Janet C. Banks. This practical how-to guide provides strategies for planning and writing thematic curriculum projects with authentic assessment tools.

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What To Watch for: Potential Pitfalls

Here are some possible problem areas to be aware of when undertaking project-based instruction (Harwell, 1997; Moursund, Bielefeldt, & Underwood, 1997; Thomas, 1998):

- Projects can often take longer than expected.
- Projects often require a lot of preparation time for teachers.
- Teachers sometimes feel a need to direct lessons so students learn what is required.
- Teachers can give students too much independence—students have less than adequate structure, guidelines, coaching, etc.
- Teachers without experience using technology as a cognitive tool may have difficulty incorporating it into the projects.
- Non-traditional assessment may be unfamiliar to some teachers.
- Arranging parents and community members to be important parts of the project is not easy to arrange and can be time-consuming.
- Intensive staff development is required; teachers are not traditionally prepared to integrate content into real-world activities.
- Resources may not be readily available for many projects.
- There might be a lack of administrative support—the district focus is covering the basics and standards in traditional curriculum methods.
- Aligning project goals with curriculum goals can be difficult.
- Parents are not always supportive of projects.

How To Avoid Pitfalls

- Cover the basics first. If you are worried about not covering the curriculum content, make sure that basic content is covered before students embark on the projects.

- Don't let the activity drive the instructional content. Let the instructional content drive the activity. Students might want to choose a project and then try to fit it into the instructional content.

- Make sure the project's purpose is tied to the curriculum or performance standards.

- Provide sufficient time for students to learn new skills or technologies, such as learning to use software programs or designing Web sites.

- Divide up the labor. For collaborative projects, help the students define their roles in project planning and implementation so that everyone is able to gain the critical skills and knowledge as outlined by the project goals. For example, everyone in the group can be an interviewer, and take part in the presentation of the final project.

- Set up timelines and project deadlines in advance to provide a structure for project activities.

- Work together with other teachers to share resources. Consider cross-classroom projects.

(Bottoms & Webb, 1998; Thomas, 1998)

Assessment of Project Work

Assessing student performance on project work is quite different from assessing traditional classwork. Because students are working on different projects with different timelines, the teacher's task of assessing student progress is more complex

than for typical classroom instruction where everyone is evaluated together.

Purpose of the Assessment

Before determining what assessment strategies would work best, the teacher needs to determine what the purpose of the assessment is. Most purposes fall into two general categories (Bonthron & Gordon, 1999):

- *Achievement*: Focus on outcomes of student learning to monitor progress and determine grades.
- *Diagnosis and Improvement*: Focus on process and look at student strengths and weaknesses to identify appropriate programs and students' learning strategies

Identify Instructional Goals and Outcomes To Develop Appropriate Assessments

Assessments measure how well the students have met the instructional goals. If the instructional goals are identified before starting the project, both the teacher and student will better understand what needs to be learned and how the learning will be assessed.

Here is an example. A project is entitled: "How do phosphates affect the water quality of a lake? Identify the causes of increased phosphate levels, and find out how to decrease phosphates to improve water quality." The identified instructional goal is to understand the effects of waste on the environment; specifically, to determine how phosphate levels increase in lakes over time. Students are assessed on the presentation of statistical information using graphs and ratios, written explanations of what the data mean, and the com-

munication of what they have learned through educational brochures, posters, videos, or Web sites.

Selecting Assessment Tasks

Select tasks that require students to demonstrate specific skills and knowledge.

Here are some questions to answer when specifying tasks (Bonthron & Gordon, 1999; Bottoms & Webb, 1998; Jobs for the Future, n.d.; Moursund, Bielefeldt, & Underwood, 1997). Do they:

- Match specific instructional intentions? (use models, graphs to solve problems, analyze relationships)
- Represent skills students are expected to attain?
- Enable students to demonstrate progress and capabilities?
- Match real-world activities?
- Cut across disciplines?
- Provide measures of several goals?

For example, an assessment task can be using graphs to compare phosphate levels in various lakes. The graphs are a visual representation of the student's attaining the instructional intentions: analyzing relationships among variables and mathematical analysis. The graphs match real-world activities by measuring real-world data from the community. Explanation of what the graph shows (whether verbal or written) not only demonstrates mathematical ability, but also reasoning and interpretive skills, and the ability of students to use the graphs to analyze social implications of the data.

Ongoing assessment on the part of the teacher and students is important so that the students can adjust projects to meet

expectations and keep on track with timelines and goals. Teachers should determine if there are checkpoints at various stages, if students are expected to meet certain milestones while working, and if students are receiving timely feedback on work-in-progress from teachers, mentors, and peers (Jobs for the Future, n.d.).

Student Self-Assessment

Because project learning is student driven, assessment should be student driven as well. Students can keep journals and logs to continually assess their progress. A final reflective essay or log can allow students and teachers to understand thinking processes, reasoning behind decisions, ability to arrive at conclusions and communicate what they have learned.

Some questions the student can answer in a reflection piece are (Edwards, 2000):

- What were the project's successes?
- What might I do to improve the project?
- How well did I meet my learning goals? What was most difficult about meeting the goals?
- What surprised me most about working on the project?
- What was my group's best team effort? Worst team effort?
- How do I think other people involved with the project felt it went?
- What were the skills I used during this project? How can I practice these skills in the future?
- What was my final project evaluation rating? Horrible, OK, pretty good, great? Why?

How Are You Doing?

The Six A's of Project-Based Learning Checklist (adapted from Steinberg's Six A's of Successful Projects in Steinberg, 1998) can be used throughout the process to help both teacher and student plan and develop a project, as well to assess whether the project was successful in meeting the instructional goals.

Authenticity

- Does the project stem from a problem or question that is meaningful to the student?
- Is the project similar to one undertaken by an adult in the community or workplace?
- Does the project give the student the opportunity to produce something that has value or meaning to the student beyond the school setting?

Academic Rigor

- Does the project enable the student to acquire and apply knowledge central to one or more discipline areas?
- Does the project challenge the student to use methods of inquiry from one or more disciplines (e.g., to think like a scientist)?
- Does the student develop higher order thinking skills (e.g., searching for evidence, using different perspectives)?

Applied Learning

- Does the student solve a problem that is grounded in real life and/or work (e.g., design a project, organize an event)?
- Does the student need to acquire and use skills expected in high-performance work environments (e.g., teamwork, problem solving, communication, or technology)?
- Does the project require the student to develop organizational and self-management skills?

Active Exploration

- Does the student spend significant amounts of time doing work in the field, outside school?
- Does the project require the student to engage in real investigative work, using a variety of methods, media, and sources?
- Is the student expected to explain what he/she learned through a presentation or performance?

Adult Relationships

- Does the student meet and observe adults with relevant experience and expertise?
- Is the student able to work closely with at least one adult?
- Do adults and the student collaborate on the design and assessment of the project?

Assessment Practices

- Does the student reflect regularly on his/her learning, using clear project criteria that he/she has helped to set?
- Do adults from outside the community help the student develop a sense of the real world standards from this type of work?
- Is the student's work regularly assessed through a variety of methods, including portfolios and exhibitions?

Professional Development for Teachers

Developing and planning project-based instructional curricula is quite different from planning traditional curricula. Teachers who aren't experienced with implementing project-based instruction may feel overwhelmed at first. Administrators can provide essential support to teachers by providing coherent, sustained professional development that focuses on teachers building the skills needed to plan

and manage project-based learning (Bottoms & Webb, 1998). Teachers need to know how to formulate guiding questions for students, help provide resources and community members who can relate the project to real-world issues and problems, encourage students to work productively in small groups and independently, and use appropriate assessment tools. In addition, staff meeting and project-planning time need to be allocated so teachers can share ideas and discuss problems. Teachers are much more enthusiastic about implementing new strategies when they have the backing of the administration.

Skills of an Effective Coach

The teacher's role in project-based instruction is very important. The teacher often acts as a coach in guiding students through the process. Some necessary skills include (Martin & Baker, 2000):

- Analyzing tasks and skills needed to carry out the project
- Facilitating the process of analyzing project tasks, setting up the plan of action, and implementing and evaluating the project
- Determining how the project will contribute to the students' learning
- Facilitating decisionmaking, thinking, and problem-solving skills
- Facilitating students' demonstration of personal responsibility, self-esteem, and integrity
- Facilitating students' growth of interpersonal skills, such as working as teams, working with community members, and working with people who are of diverse backgrounds

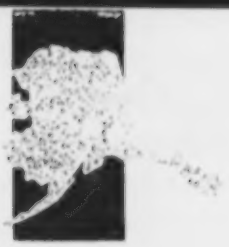
CONCLUSION

This booklet only touched the surface of project-based instruction. The reference and resources sections list additional tools to guide teachers through the process.

Planning and implementing effective projects can be challenging at first, but if teachers are given time to plan and are supported by their administrators, they can make education come alive for their students and encourage students to take initiative for their own learning.

NORTHWEST SAMPLER

Following are some descriptions of innovative projects in schools around the Northwest (previously published in NWREL's Spring 2002 issue of *Northwest Education* magazine). We hope that you will find some great ideas for projects from these educators, and encourage you to contact them for more information.



Location

Tri-Valley School
P.O. Box 400
Healy, AK 99743

Contact

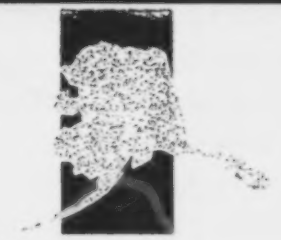
Sheila Craig, Technology teacher
Phone: 907-683-2267
Web site: http://www.denali.k12.ak.us/dbsd.homepage/healy/tri-valley/trivalley.html

Rediscovering Coyote and Raven: The Ancient Art of Spirit Masks Moves Into the Digital Age

—By Joyce Riha Linik

Around campfires, generations of masked dancers have re-enacted legends of a long-ago world. They've told stories of Coyote the trickster and of clever Raven, said to have stolen the sun and brought light to the skies. Today, one small-town school in the Alaskan wilderness is bridging these tales of the ancients with modern technology as students take the study of spirit masks high-tech.

At Tri-Valley School near the northeast edge of Denali National Park, middle school students are researching animal symbolism on the Web, designing three-dimensional masks with computer graphics programs, and making and editing digital movies of their mask-making endeavors. Along the way, they learn about differences in world cultures, practice their writing skills, and gain exposure to the fine arts.



This 10-week interdisciplinary project is the brainchild of Tri-Valley technology teacher Sheila Craig. She came up with the idea after participating in an intensive professional development program called ARCTIC (Alaska Reform in the Classroom through Technology Integration and Collaboration) two years ago. This effort, funded by the U.S. Department of Education, helps teachers learn to weave technology into instruction in relevant and useful ways and to design effective learning environments that incorporate technology.

"ARCTIC introduced me to project-based teaching and made me think about using technology tools in a different way," Craig says. "I used to teach computer applications courses," where technology skills were separated from other academic disciplines. "Now," she says, "I teach academic content using technology as a tool" to support learning.

The difference for students is clear. Craig reports that lessons are "more meaningful and more relevant" to them—"things make a lot more sense." In short, she says, "It's a more holistic way of learning."

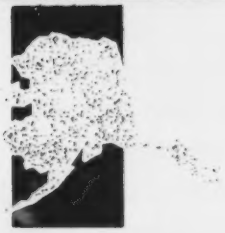
It wasn't only the technological angle of the spirit mask project that resulted from Craig's ARCTIC experience. It was there that she saw the artistic potential, as well. During the training, Craig spent a semester team teaching in Columbus, Ohio, with another Alaska participant, Marilyn McKinley, a fine arts specialist. Because Craig's little school in Healy had no art teacher, she seized on the chance to blend art and technology for the enrichment of her students back home. Craig credits McKinley with helping her

develop the spirit mask unit and figure out how best to integrate the subject areas.

Craig had another motivation for teaching the spirit masks unit. "We have a very diverse population in Alaska," she observes. Alaska Native populations in the state include the Inupiaq, Yup'ik, Alutiiq, Athabaskan, Tlinkit, and Tsimshian, among others. Craig felt her students, who are primarily white, should learn about and gain an appreciation for these rich and varied cultures. "It's important," she says, "that kids have tolerance for people whose ideas are different than their own."

During the course of the project, students study animal symbolism in indigenous cultures, not only in Alaska and the Pacific Northwest, but around the world. They also examine values and beliefs regarding such fundamental issues as the passage of time, treatment of the elderly, and child-rearing practices. Comparing traditional Native American and European values leads students to higher levels of thinking and inspires animated discussions among those who identify with elements of both cultures. Ultimately, Craig says students see that "we are this melting pot of cultures."

The exploration eventually brings students to the study of Northwest Coast and Yup'ik spirit masks, which were often used for telling stories about daily life (for instance, stories of the hunt). They were also employed for teaching lessons through cautionary tales, not unlike such European American classics as "The Tortoise and the Hare" and "The Ant and the Grasshopper." Finally, students choose an animal that intrigues them—one whose characteristics and



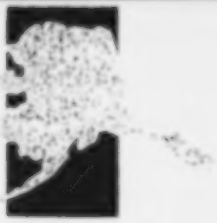
qualities they admire, feel they possess, or hope to develop. They then create a mask to represent their "spirit animal," designing it first on the computer and then building a three-dimensional plaster version with their hands.

Sam, an eighth-grader, is moved by native legends of the raven. In his journal, he writes that he has chosen the raven not only because it is intelligent and sometimes tricky, but also because it is "a leader," a trait he himself hopes to attain. His mask, painted black with highlights of blue, features a prominent orange beak. At each temple, he incorporates a traditional Native American element by attaching a feather on a beaded leather string.

Another student, Jessie, selects the clever and discreet fox as her inspiration. To mimic the texture of fur on her mask, Jessie attaches red and white feathers.

While a lot of students create images of local animals such as caribou, moose, and bear, Craig is surprised to see how many kids are drawn to exotic animals from distant places. Letitia, for example, picks the tropical clown fish because of its colorful body and its graceful way of moving through the water, "kind of like dancing or flying in a dream."

Throughout the mask-making process, students work collaboratively, documenting the experience with digital photographs and videos, and helping each other with technical challenges. They then create their own movies and multimedia HyperStudio stacks. The students keep an online journal throughout the project and write a variety of essays. Finally, they present their work to their classmates.



A number of state standards are braided into project goals. For example, students:

- Gain an understanding of the historical and contemporary role of the arts both inside and outside Alaska
- Use technology to explore ideas, solve problems, and derive meaning
- Organize and use information to create a product
- Apply elements of effective writing and speaking
- Learn to create and perform in the arts

"It's really an alternative-type class," says Craig. "Some kids are motivated by the hands-on element of art and technology." For that reason, this project reaches students who might otherwise be left behind. It has been especially effective with troubled and learning disabled students. "Adults sometimes have misconceptions that these students won't be successful at technology," Craig says, "but that isn't the case." Often, in fact, "they pick it up and blow people away. Technology is one area where kids who don't experience success in other areas can experience success."

The students in Craig's multiage class voice disappointment that the mask project comes around only once in their middle school years. But she is working to develop other projects that are equally "exciting and inspirational and motivating." In fact, Tri-Valley School now provides common prep time for teachers precisely so they can collaborate on just this kind of interdisciplinary project—an owlish gesture, to be sure.

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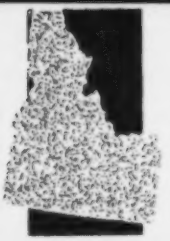
Lessons in the Loop: Idaho Kids Learn Physics, Math, and PR When They Design and Market a Roller Coaster

—By Joyce Riha Linik

"The Regurgitator" seems an appropriate name for a roller coaster that sends one's stomach lurching, spiraling, and somersaulting through dramatic maneuvers known as batwings, corkscrews, and loops. At least, that's what some 14-year-olds at Twin Falls' Vera C. O'Leary Junior High School think. Childhood visits to amusement parks taught these kids that the bigger the gastrointestinal challenge, the better the ride. So when they were asked to design a roller coaster as part of their eighth-grade curriculum, they were more than happy to oblige, devising detailed plans for a super hurler that could outdive, outspin, and outloop the best coasters on the planet.

This unusual course of study is part of a technology-supported, interdisciplinary project called "It's a Wild Ride." The eight-week unit, led by teachers Theresa Maves, Meile Harris,



and Jill Whitesell, integrates science, math, and language arts. And it brings some complex concepts into clearer focus for kids.

When students first discover they'll be studying roller coasters, they're "surprised," says Maves. "They're amazed that something like a roller coaster could be academic instead of just recreational." They think the project will be fun.

It is. But students quickly learn that there's more to a roller coaster than churns the stomach. The project isn't just playtime; it includes real work as students grapple with the laws of motion, linear and nonlinear equations, and technical reporting. But the high fun quotient keeps students moving through what might otherwise be rocky academic terrain.

Concepts come alive through hands-on learning. Instead of just reading about Newton's laws of motion in a textbook, students get to see how these principles determine the movement of a car (or, for classroom purposes, a marble) on a roller coaster track. Instead of just practicing mathematical equations through classroom drills, students get to see how these equations can predict whether the moving object will be able to stay on track through a 360-degree vertical loop. In short, kids get to see real-world applications for the material they're covering in school.

As a math teacher, Harris says, "Kids are always asking, 'Are we ever going to use this?'" They often see math as "boring number-crunching" unrelated to the real world. "But there's so much more to it," the teacher asserts. Math is, in fact, best taught in interdisciplinary projects where students can see

the connections, she says. "Projects like this show kids that math is everywhere, behind everything, including a roller coaster."

Students discover that the real world isn't divided by subject matter. "We really want students to see that outside our school world, science does not stand alone," Maves reports. Nor does language arts, adds Whitesell, noting that the project allows her to "weave" reading and writing into science and math curriculum. Kids find out that literacy skills are necessary for most real-world jobs, even if you don't plan to be the next great American novelist.

The concepts and skills covered in the project are tied closely to district learning goals and state standards. "When we design learning activities," Maves says, "we start with standards and benchmarks and let those be our guide." Deciding on the "what" comes first. The roller coaster project simply provides the "how," serving as an application example.

Additionally, technology is used in a variety of ways to support learning. This includes access to computers for help with calculations and design, as well as access to the Web for research. Students also use graphics programs for their group projects.

Phases of the project include:

- Accessing prior knowledge about roller coasters
- Investigating content-specific skills and knowledge with experiments in math and science that build understanding about force and the laws of motion
- Expanding knowledge of roller coaster design with research and further experimenting related to roller coasters

- Applying new knowledge to the design and construction of a roller coaster model
- Contributing knowledge to a group roller coaster design in one of four careers: engineering, architecture, research, or public relations

In the application stage, students design and build their own scaled-down roller coaster, using such materials as old garden hoses, foam pipe-insulation tubing, and anything that can be stacked or connected into a kind of scaffold. Students then cut the hose or foam tubing to create a track that is draped, twirled, and secured to a frame. Elements of the coaster must include a drop, a loop, and an inversion. Different-sized marbles serve as vehicles for a series of experiments on how mass, weight, speed, and acceleration interact when the marbles hit the track.

One of the things students learn from these experiments is that "the marble must have enough velocity to make it through the inversion," says Maves. This means the inversion needs to be near the beginning of the track where force and velocity are greatest, and before too much friction has come into play.

The expansion phase includes using K'nex-brand building models in math and science, as well as probeware, computer-based data collection tools that help students with various calculations. One such calculation involves the use of "photogates"—electronic timers that can calculate the acceleration of a marble traveling through a vertical loop. Harris says last year's students were perplexed when they came up with a negative value. This led them to repeat the experiment several times, each time getting the same result. Suddenly, the

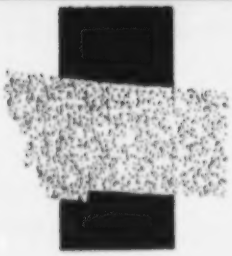
class had an "Aha!" moment when they realized that the loop absorbs energy, slowing the marble down. It was possible to have negative acceleration!

After individual projects, groups of students work together to design a real-world coaster, taking on job assignments as engineers, architects, researchers, and public relations specialists. This work is more indepth than the individual coaster project, requiring multiple calculations and laborious research, as well as the development of marketing and advertising plans for selling their product. This group work provides another learning opportunity for students and increases their knowledge of possible career paths down the road.

Everyone involved agrees that the project has been a success. "Students' excitement for roller coasters keeps them motivated," observes Maves. "And that gets them to problem solve and attain high-level thinking."

Adds Harris, "Anytime students personalize learning, they take away more meaning." In short, "Things make sense."

And that makes Twin Falls' "wild ride" well worth the trip. For more details on this and other projects that integrate technology into the curriculum, check out Intel's Innovating in Education Web site at www.intel.com/education/index.htm.



Location

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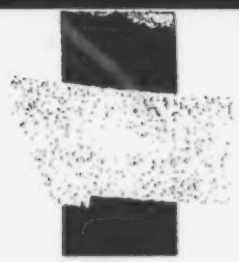
New Life for an Old War: Even the Graffiti Suggest History Has Taken on New Meaning for Flathead Students

—By Maya Muir

When English teacher Christa Umphrey began a unit on World War II with her high school freshmen, her initial thought was how very long the next months would be. When she asked for questions about Pearl Harbor, the students came up with such insightful queries as, "Why did we bomb them?" and "What country is it in?" Many of her students couldn't figure out why they should care about the war at all. To these kids growing up on the Flathead Indian Reservation at the turn of a new century, the war seemed awfully long ago and far away.

But by the time those freshmen had completed a semester-long project involving history, earth science, math, drama, band, and choir in addition to English, Umphrey found the perspective of those same kids transformed.



"When one of the four schools in our district was found a 'School in Need of Improvement,' the superintendent mandated that all schools adopt a comprehensive whole-school reform model," says Ronan Principal Sandy Welch. "We chose a project-based model because the staff said that we'd get the same results if the teaching didn't change. Project-based teaching was a real change."

Umphrey broke the ice by having her students look through a number of books on the war, followed by brainstorming questions. Then she took them to see the movie "Saving Private Ryan." Immediately, she sensed a breakthrough. Students were caught, curious. Umphrey followed with readings such as Elie Wiesel's *Night* and John Hersey's *Hiroshima*. The class examined war memorabilia at a museum and heard a woman talk about having been in the Resistance in Holland.

Then students interviewed local WWII veterans, bringing the war home in a new way. "My favorite project was my interview," says student Stacy Harris. "I got to know my grandma better and find out about World War II from someone who lived through it." Students wrote up these biographies. In art class, they drew portraits of their subjects from photographs.

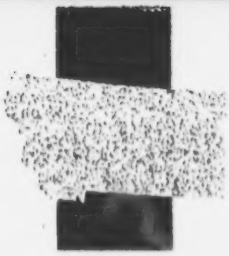
In math, students studied the invention and use of radar. They researched the physical activity and caloric intake of a European soldier, a U.S. soldier, a Holocaust survivor, and a French farmer, then graphed their findings using Microsoft Excel. In earth sciences, the kids mapped Germany and Japan and studied their natural resources.

Midsemester, a drill instructor arrived in Ronan to put students through a simulated "boot camp." He taught drills and rudimentary first aid, and gave them a small dose of military history along with some MREs (Meals Ready to Eat). Even initially skeptical students enjoyed the experience.

At Christmas, the drama and choir classes collaborated in a wartime musical, *I'll Be Home for Christmas*. The choir sang 1940s songs while the drama classes designed sets and costumes and took on the roles of a family from that era.

The culmination of the semester came in January with the presentation of a World War II open house in the high school gym. The room was filled with exhibits, computer-generated images of the war projected on the walls, and proud students ready to explain their particular project to anyone interested. "It was so nice to see all the elders' faces when they saw everything we'd been working on," says freshman Krystle Slover. "They looked so happy." In one corner, Cathy Gillhouse's choir put on a USO-style show, singing "Boogie Woogie Bugle Boy" and other 1940s hits in front of the red, white, and blue.

Another high point of the open house was the band's recital of "Dresden in Memoriam," a commemoration of the firebombing by Montana composer Dan Bukvich. A difficult piece under any conditions, it was a challenge for the Ronan band, starting with the piece's nontraditional notation. But it intrigued students from the first time bandleader Jeff Long played them a recording of it. One student said, "Mr. Long, if we play this, the audience will cry." Long replied, "That's the point of music." The kids rose to the occasion, perhaps



inspired by a visit from the composer who came to work with them on the piece.

The unit was deemed such a success that it is being repeated this year with only minimal changes. Sandy Welch notes that through the project, teachers were able to engage many students who weren't normally high achievers. For example, a perennially disgusted and uninvolved student of Umphrey's arrived one day with a backpack full of material on the war gathered from family members, along with already-underlined Internet printouts. And Umphrey found herself laughing one day at some new graffiti on one of her already battered desks. A previously existing hole in the desk had been labeled "Hiroshima." "Maybe that student could even tell me where Hiroshima was," Umphrey observes, "or what country bombed it."

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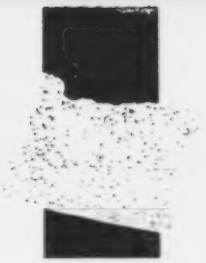
Marimba Magic: An African Music Tradition Fills After-School Hours With Rhythm—and Learning—at a Willamette Valley School

—By Bracken Reed

Crystal, a fifth-grade student at Bush Elementary School, stands over the bass marimba, all of her energy focused on executing a complicated new part. Two, three, four times she makes a mistake and starts over.

"That's OK," says the director, Martin Sobelman. "That's what rehearsal is all about."

The 13 other students in the band sit patiently, focused on Crystal's playing, nodding their heads or tapping their feet in time with her rhythm. No one laughs when she makes a mistake; no one squirms with impatience or yells out that they could do better.



"There you go," says Sobelman, as Crystal begins to lock into the part. "All right now!" He turns to face the rest of the band. "Are you ready to join her?" he asks with obvious enthusiasm, as Crystal continues to lay down the complicated pattern behind him, her brow still furrowed but a smile showing at the corners of her mouth. Crystal stops playing, and her bandmates give her a quick round of applause. Then Sobelman counts out the time and the full band begins. The room is suddenly alive with rich, full chords and a fabulously syncopated rhythm. Pure marimba magic.

A few bars later the sound collapses in a train wreck of missed parts and embarrassed laughter from the whole group. But it doesn't matter—the moment was wonderful and they can feel it. A little more practice and they'll have it. This is serious fun.

The Bush Elementary Marimba Band is part of an after-school learning program run by the Salem-Keizer School District. Partly funded by a federal 21st Century Community Learning Center (CCLC) grant, it has been a runaway success. The project consists of two different groups, one for fourth-graders and one for fifth-graders, each meeting once a week from 3 to 5 p.m., and during one lunch break.

"To build a successful project," says Gaelen McAllister, a parent volunteer at the school and the co-writer of the grant, "you have to start with someone's passion."

It's the same with the other projects in the after-school program, says Teri Urban, who directs 21st CCLC projects for Salem-Keizer. "You have to have someone who goes out in the community and finds volunteers or teachers with spe-

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cific interests. You find out what they're good at and design a project around that, rather than telling them what to do."

Sobelman, the school's music teacher, was the genesis of the marimba project. A fellow music teacher in the region first told him about a similar marimba band project. It seemed like a perfect fit for his school. Bush Elementary ranks among the 10 highest-needs schools in the state. A Title I Schoolwide school with more than 80 percent of the students on free or reduced-price lunch, it is also a bilingual school with nearly 50 percent of the students coming from Spanish-speaking homes. While marimba music originated in Africa, it spread to the Caribbean and from there to Latin America and beyond.

"The main elements of marimba music are found in every culture," says Sobelman, "It's something that appeals to people from many different backgrounds."

One of the main goals that Sobelman and the grant writers set for the program was to connect it with the larger curriculum. "We wanted to tie it to academics in a very concrete way," says McAllister. This has been done in two different ways. First, the students must maintain a high level of attendance and academic achievement to be a member of the touring band. This is a rigorous, "no excuses" policy. Yet, as Sobelman points out, the program has had "very, very few" students who have been unable to meet these requirements.

Second, Sobelman makes every attempt to teach marimba music in a cross-curricular manner, tying it to a wide variety of subjects as explicitly as possible. Practices are spiced with details about the cultural background of each composition,

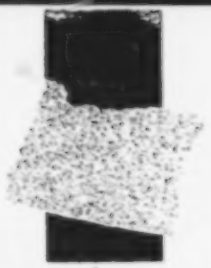
the mathematical patterns underlying the music, the social-historical context, the technology and craft involved in the design of the instruments, and the similarities with other art forms and styles of music.

"Kids who hear a lot of music are better at math," says Sobelman, pointing out that marimba, with its complex rhythms and interweaving of patterns, is particularly easy to relate to the larger math curriculum.

The marimba band has also tied in with several of the school's other goals. "It's one more way to get parents involved," says Rita Glass, the school's community school outreach coordinator. All the after-school programs include an afternoon snack and buses that arrive at 5:30 p.m. to take the students home. "When you eliminate barriers—food, driving—your chances for success are much greater," says Glass. "Just providing transportation has increased the program by half."

The marimba band and other after-school projects have given parents a much greater identification with the school, which has helped reduce a traditionally high mobility rate. "Parents are saying, 'It's worth keeping my kids at this school,' " says Urban. "Because of all the good programs we have in place and the effort we make to be bilingual, if they do have to leave for a while, they make an effort to come back here."

One further effect of the Marimba Band has been to increase community outreach. The band has performed at the state capitol, the local World Beat Festival, the Oregon fiesta, and several other events, to great acclaim. "People see these kids



performing really complex music at a very high level—they get a different view of what Bush Elementary is," says McAllister. "Our philosophy has been to build a program, teach the kids, and take it to the community. The response has been very positive."

Probably the greatest result of the project, however, has been its effect on the kids. The beaming smiles and obvious pride they take in the band are testament to the success of the project.

"We all have fun," says Whitney, one of the fifth-grade band members. "It's fun to play an instrument and to know you can do things, accomplish things."

Her bandmate, Ana, puts the success of the project in succinct, fifth-grade terms: "It makes everybody jealous that we're in the band," she says with a huge smile.

Location

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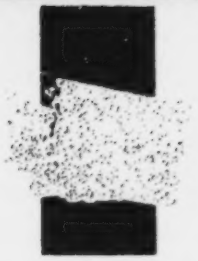
A Talking Book: An Endangered Language Flourishes Again at a Puget Sound School

—By Amy Fisher

After the rumblings of the earthquake subside, teachers and students evacuate Tulalip Elementary School in Marysville, Washington, while administrators check to see that there is no damage to the building. Everyone is safe, and students, excited by this extra "recess," begin chatting, wiggling, jumping, and playing clap-and-rhyme games while trying to remain in their classroom lines.

Surrounded by this commotion, one class of fourth- and fifth-graders stands out. Instead of giggling and gyrating, these kids are concentrating intently on their teacher, who is calling out words and phrases in the ancient language of Lushootseed.

"*ey,s-YAH-yah*," he prompts. Kids' hands shoot up. "Hello, friend!" a student responds. "*us-CHAL chuwh*," the teacher says. "How are you!" a student answers.



Eagerly, the youngsters volunteer English translations for words that were spoken for countless generations by the Tulalip Tribes that inhabited the evergreen forests and rocky beaches of east Puget Sound. The teacher even sneaks in a math problem, asking the students to estimate how long their arms and legs are in *hweetl* (a traditional Tulalip unit of measurement that is the distance from the middle finger to the thumb). Once again, nearly every hand shoots up to answer the question.

What is the reason for this high level of focus and engagement among 10- and 11-year-olds? What motivates these students to participate while their peers play? The students' interest is particularly surprising at this school, whose student population is two-thirds American Indian, a group that typically struggles for academic success.

The reason for the children's enthusiasm is clear to teacher David Cort. At Tulalip Elementary School in the Marysville School District, he says, culture and curriculum are being fully integrated, with the lyrical Lushootseed language at its center.

"Students learn about our rich local culture, which enhances the self-esteem and investment of Native students," says Cort, the Lushootseed teacher and technology coordinator for the district. "The program also increases the self-esteem and sense of place of non-Native students, as they develop a deep familiarity with the culture and first language of their home."

Located about 40 miles north of Seattle, the 22,000-acre Tulalip Reservation sits on the shores of Puget Sound. Tulalip Elementary School overlooks Whidbey Island, with

the Olympic Mountains rising in the distance to the west. There are approximately 3,000 enrolled members of the Tulalip Tribes, which are made up of a number of smaller Puget Sound tribes, including the Snohomish, Stillaguamish, Skagit, and Skykomish. In 1992, there were only 17 elders of the Tulalip Tribes who spoke Lushootseed. About that time, the tribe established a Tribal Cultural Resources Department (TCRD) to preserve the tribe's language and culture. The tribes and the school district began a multifaceted approach that provides culture and language learning opportunities at school and in the community. It includes classes taught by TCRD teachers in preschool and the early grades; high school Lushootseed classes; elementary school classes that incorporate technology and Tulalip language and culture; language camps; language classes for community members; and other community events and activities.

A Tulalip-Based Classroom (TBC) in the fourth grade has been an option for Tulalip Elementary students in recent years when the school is able to hire needed staff. The classroom curriculum uses Tulalip language, literature, and culture along with project-based learning to connect children with their culture and to satisfy all state benchmarks.

One example of a real-world project is the creation of CD-ROM "talking books" of traditional Tulalip stories. The CD-ROMs were originally created by students for inclusion in a take-home packet for prekindergartners attending the kindergarten registration. Because the Tulalip Tribes have given each family in the tribe a computer, the CD-ROMs are software resources that provide young children with unique literacy and technology experiences at home. The project develops and applies students' skills in literacy, technology,

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art, language, and culture. Students learn to use Macromedia Flash 4, a widely used Web page design tool.

The CD-ROMs tell the stories in both English and Lushootseed, with both languages appearing side-by-side on the screen. When the user clicks on a phrase, a student narrator recites the words in an expressive voice. The students' enthusiasm for the project was apparent as they showed visitors the witty animation and sounds that they had created for the book's illustrations—spiders spinning webs and ants marching across the screen.

The project has worked so well that additional projects that integrate Lushootseed and technology skills have been developed for other grades. For example, secondary students created a computer game that teaches the Lushootseed names for the geographic features of the local Tulalip using a recently published book of Lushootseed place names. To learn more, visit the school's Web site at www.msvl.wednet.edu/elementary/tulalip_site/index.htm.

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ONLINE RESOURCES FOR PROJECT IDEAS

The Blue Web'N: A Library of Blue Ribbon Learning Sites on the Web
http://www.kn.pacbell.com/wired/bluewebn/

Co-nect's Teleprojects: Standards Based Project Page
http://exchange.co-nect.net/Teleprojects

Guide on the Side: Project-Based Learning Resources
http://www.iearn-canada.org/guideontheside.html

Education World: Collaborative Projects K-12
http://www.education-world.com/projects/index.shtml

Global School House Internet Project Registry
http://www.globalschoolhouse.org/pr/

Handbook of Engaged Learning Projects
http://www-ed.fnal.gov/help/index.html

Montana Heritage Project
Projects by Montana high school students
http://www.edheritage.org

Project Approach in Early Childhood and Elementary Education
http://project-approach.com
[Developed by Sylvia Chard, author of many research books and articles on the project approach]

Starting in the Middle 2000: Integrated Project Designs for Idaho Middle Level Students, Volume II
http://www.nwrel.org/ecc/middle_2000/

Uncommon Knowledge: Projects That Help Middle School Age Youth Discover the Science and Mathematics in Everyday Life. Volume One: Hands On Science Projects (AEL, 2000, Carter, C.S., with Keyes, M., Kusimo, P.S., and Lundsford, C.)
http://www.ael.org/eric/voices/science.htm

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